

# Critical Success Factors to Improve Perception of Information Technology Careers: A Specific Case in a Mexican Higher Education Institution

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## ABSTRACT

It is a fact that fashion plays an important role to select a career, new options of careers from engineering are preferred by students instead of traditional options; for example, Mechatronics, Aeronautics, Automotive specializations, Bionics, Biomedical and others are so popular. Every day, new necessities are required in the world and it is necessary to find the way to solve them, for that reason these new majors are good options to students, however traditional areas are important too. Information Technology is not the exception because every enterprise, school, association and organization needs computers with systems that help to solve specific situations or to manage resources. In Mexico, Information Technology careers are been affected for low enrollment of students, of course private universities have suffered more this situation than public schools [1]. In this research work are shown the most important factors that have a real incidence to choose an Information Technology career. The methodology consisted in the design of a survey using seven points Likert's scale where potential students could express more about their expectative, preferences and required abilities to study these majors. The mentioned survey had three versions and each one was validated through Cronbach's Alpha. Data collected were analyzed using statistical software SPSS to obtain the critical success factors.

**Keywords:** Education, higher education, IT careers, success factors, perceptions on IT.

## 1. INTRODUCTION

This paper is about the critical success factors that has incidence about enrollment in Information Technology (IT) careers in a Mexican higher education institution. It is a matter of fact that every year there are fewer students that want to study a bachelor related to IT or Computer Science. This situation is not

exclusive from Mexico, it is a problem of other countries like United States [2], and for that reason employers and universities are worried. In search of a reason, the most common answers are: wrong ideas about people who like IT, people think they know computer science just because they can chat, do a web page, look for information in Internet, use social networks, use web 2.0 tools and other informatics tools. In reality, this kind of majors are not attractive to high school students and for that reason the number of graduates is not enough to satisfy the necessities of IT industry [3].

In the institution where the study was done, every year, the number of students decreases; however, regional employers call to the institution looking for students who want to work for them. Because of demand cannot be satisfied, the "intrusion" has been presented. The intrusion means students from other areas like Mechatronics, Industrial Engineering, Electronics, Bionics, and other engineering majors are holding IT. It seems a good solution because the company can hire a person that apparently will resolve the problems. However, it is necessary to keep in mind that training to persons is really expensive; furthermore, if persons do not have the right profile, the performance will not be satisfactory. Definitively, the university gives important knowledge, abilities and competences that sometimes are difficult to acquire in a job.

This is the beginning of future investigation which could take to discover new facts.

## 2. CHOOSING A BACHELOR

There are several important factors that students in Mexico take account to choose a bachelor. In the Mexican culture, the parent's opinion is important because they pay the university fees; besides, they have a lot of influence on decisions. If parents do not understand the importance of a career, probably they tell him (her) that there is another career more interesting.

Another factor is fashion or trend, sometimes teenagers want to belong to a group and sometimes they do not have enough maturity to make decisions by themselves, and then the influence from friends and classmates is significant. The fashion is generally attractive because the newer can result from a mix of areas that are looked for students, for example: Biomedical, Mechatronics, and more.

Vocational guidance test is generally done in high school; however, sometimes the students do not mind the result. At the university where the study was done, before they can do a change of career, they must have an interview with psychopedagogical area to discover the real interests, abilities and vocation. It does not mind if they have done a test in high school, for the institution it is important that the students do the tests again to clarify the real vocation, interests, motivations, and more [4].

More important factors in choosing bachelor are advisors and recommendations from parents and teachers, for that reason it is crucial that they can be informed about real expectations and options for a professional of Information Technology. To help solving this problem, the interdisciplinary and inter-institutional work is important because in that way professionals can help high school teachers to show the real impact of every career, the attitudes, abilities and discipline necessary, the specialization areas and available opportunities [5].

Nobody can avoid perceptions; people think and act according to their own point of view. The students from high school must research about options for studying their bachelor, trends, important enterprises related with each area, specialization options, development opportunities, salaries, certifications, interdisciplinary areas, and more. If a student is informed and knows about the decision that he will take, the probability of mistake decreases and he could feel more satisfied and sure about the decision taken.

The Table 1 shows a list of some important factors that are considered by a Mexican student when he chooses a bachelor.

Liking for:	Parents opinion
<ul style="list-style-type: none"> <li>• Math</li> <li>• Physics</li> <li>• Logic</li> <li>• Collaborative work</li> <li>• Videogames</li> <li>• Technological mode</li> <li>• Programming</li> </ul>	Friends opinion
Curricula	Teachers experience
Leadership of student	Abilities in:
The practice and the theory for the student	<ul style="list-style-type: none"> <li>• Relationships</li> <li>• Negotiation</li> </ul>
Promotion in high school	Job options
News about IT	Internationalization options
	Working with hardware
	Working with software
	Implementing new ideas and concepts in enterprises

Table 1: Important factors to choose a bachelor

### 3. THE PROBLEM

Now, technology has become much friendlier in the work environment and in the education it has won importance. It is

becoming more needed to compete in a globalized world. Ten years ago, to perform certain activities such as web sites, was required to have some specialized knowledge, but now, those technologies are friendlier, almost anyone can do that and much more. Of course, high school students have several abilities that allow them use software without problems.

The institution, where the research was done, is offering three programs related to Information Technology: Computer and Systems Engineering, Software Engineering, and Information Technology Bachelor. Over time, it has been noted that fewer students choose to study a career in computing, this problem is not unique to this institution, and it occurs widely in Mexico and the world [6]. Some Mexican Private Higher Education Institutions have decided to close programs on Information Technology Bachelor due to low enrollment that has caused them to stop operating with its own economic resources. There are several studies that indicate why many students do not choose some career in engineering [7], some of the conclusions that have been found are because they are afraid of Math, some others who are not afraid of the exact sciences are choosing majors in fashion as Mechatronics Engineering or Automotive Engineering Design, a few others who manage the office tools, believe they already know everything they need on the computer and are not attracted by the further study in these areas, some students report they feel uncomfortable in computation's areas because of the way high school's teachers taught the material, others prefer to seek other areas because believe Computer Science's people do not like to work in a collaborative way [8].

On the other hand, it is really easier to use the computer, the tools have become more intuitive and it is not necessary to have specialized knowledge for the use of certain technologies. Because of that situation, the students have lost the idea that there are other computing tasks that are extremely interesting which require specialized knowledge. It is in that moment, when people realized it is necessary to study Information Technology. The benefits of studying in these areas are many, such as labor demand, the very extensive areas of research, specialization options, and good salaries related to others disciplines and the contributions that students can make to our society and almost always are of great relevance and impact to our environment [9].

Today, the demand of specialists in these areas is greater, so universities cannot satisfy it, students should be interested in enrolling in IT majors; however, the reality is that few students are interested in learning formal Information Technology. Studies show that in the period from 2008 to 2018 there will be an increase in these job areas about 53.4%, this means about 448,000 new jobs in México [10]. Areas that have more demand are directly related to programming, testing and maintenance of systems, installation and configuration of networks and technologies related to e-business and business intelligence [11].

At the university where the phenomenon is studying, the last year the program Information Technology Bachelor was closed due to low enrollment, the last time this program was offered only two people signed up. The other two Engineering programs have not been closed, but enrollment does not increase, on the contrary, decreases. This means that both programs are at risk of disappearing from the institution. As part of the contradiction, the job bank, visits and phone calls by companies requesting students for internships and full-time

contracts are increasing every day; however, the university cannot provide a solution to this problem in our society.

As noted, the programs that have been mentioned are traditional. Some universities are trying to solve this problem offering interdisciplinary courses about Information Technology applied to other areas, such as Graphic Design, Biology, Law, and others. Information Technology can apply to those areas and can interrelate with many others [12]. To find out which areas are relevant, it is necessary to study the issue and review the feasibility of these mergers.

Companies come to universities to propose to teach certain technologies that enable the students enter to a job in an easier way. This Mexican University is open to these requirements and is flexible to ensure that students have the best knowledge, but if the institution does not have students interested in careers about IT, little or nothing can be done. Making those decisions are not easy, for that reason there is a committee integrated for recognized people from academic areas and people from important national e international enterprises that recommend the changes that must be done to the programs.

It is supposed that universities must respond appropriately to the needs of local, regional and national work environment; however, there are not enough professionals in Information Technology, the vacancies are filled by professionals from other areas that do not have the rigor of knowledge and which will probably implement mediocre solutions causing a bad impression and degrading practice of the profession itself, a phenomenon known as "intrusion". Another situation that does not help the companies is the training given to people who are hired from other or similar bachelors; this cause great expense and not always achieved the desired results.

#### 4. METHODOLOGY

The methodology consisted in the design of a survey using seven points Likert's scale where new students of IT could express more about their expectations, preferences and required abilities to study these majors. The mentioned survey had three versions and each one was validated statistically through Cronbach's Alpha [13]. The first and the second version had a comments area where students could suggest about the questions and those suggestions were important in the design of the third version because in that way it could be improved in the following aspects: re-writing of ambiguous questions, the review of structure of all questions where all of them were converted to forced choice question, ranges for ages were created, a new question was added because it was important to know the general satisfaction level.

The three survey's version used seven points Likert's scale with the following possible answers: Not important at all, very little important, not much important, indifferent, important, very important, and extremely important. The final survey was applied to 103 persons; the sample was a statistic census to the students of new entry. The final design of the survey was: thirty questions about factors and 6 questions with statistically information the person who answer. Data collected were analyzed using statistical software SPSS to obtain the critical success factors and then it was made a classification of them.

#### 5. DATA ANALYSIS

Once the third version of the survey was ready, the reliability level was reviewed. The Table 2, shows the value of

Cronbach's Alpha for this version was 0.790, it means that the survey was reliable.

Cronbach's Alpha	N of Items
0.790	29

Table 2: Cronbach's Alpha Value

And, as seen in the Table 3, Kaiser-Meyer-Olkin measurement was bigger than 0.5, so it was concluded that factor analysis was appropriate.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.528
Bartlett's Test of Sphericity	Approx. Chi-Square	1818.765
	df	406
	Sig.	0.000

Table 3: Kaiser-Meyer-Olkin Measurement

Also, the variance was explained in 76.15% and the SPSS statistics 19 suggested nine factors. So, from the last results the factors were classified as is shown in Table 4 and Table 5.

Factor one: Social abilities	Factor two: Business preparation	Factor three: Information	Factor four: Science	Factor five: Technology
Ability in relationships and communication	To have an affinity for logic	Friend's opinion	Math ability	To be interested in current trends and mode of technology
Negotiation ability	Process improvement	Promotion of career in high school	Physics ability	To be interested in learning more about hardware of computers
Collaborative work ability	To have an affinity for management	High school professor's opinion	Programming ability	To be interested in learning more about software of computers
Social abilities	Leadership abilities	News about Information Technology	To have an affinity for Math	
	Curriculum of the career			
	Professor's experience			

Table 4: Five of nine factors classification

Factor six: Projection	Factor seven: Remuneration	Factor eight: Trends	Factor nine: Practical
Job opportunities	Salary of IT professionals	Trends and mode in new careers offered by universities	The relationship between theory and practical in university classes of IT
Internationalization options		Parents opinion of students	
The reputation of the university		To be interested in videogames	

Table 5: Four of nine factors classification

After those results, the data was reviewed again in SPSS statistics 19, and varimax rotation was used [13] to identify the factors which were explained in the case of study. Also, it was forced the division in more factors to know if increasing the number of factors; the total explained variance was better.

After several tests, it was found that 14 factors increased the variance's explanation to 87.65%. So, from the last results obtained, they were classified like is shown in Tables 6, 7 and 8.

Factor one: Social abilities	Factor two: Information	Factor three: Technology	Factor four: Science	Factor five: Business preparation
Ability in interpersonal relationships and communication	Promotion of career in high school	To be interested in current trends and mode of technology	Math ability	Process improvement
Negotiation ability	High school professor's opinion	To be interested in learning more about hardware of computer	Physics ability	To have an affinity for management
Collaborative work ability	News about Information Technology	To be interested in learning more about software of computer	To have an affinity for Math	Leadership abilities
Social abilities				

Table 6: Five of fourteen factors classification

Factor six: Logic and Professors	Factor seven: Projection	Factor eight: Practical	Factor nine: Videogames	Factor ten: Programming
Professor's experience	Job opportunities	The relationship between theory and practical in university classes of IT	To be interested in videogames	Programming ability
To have an affinity for logic	Internationalization options	Trends and mode in new careers offered by universities		Curriculum of the career

Table 7: Five of fourteen factors classification

Factor eleven: Remuneration	Factor twelve: Parents	Factor thirteen: Institution	Factor fourteen: Friends
Salary of IT professionals	Parents opinion of students	The reputation of the university	Friend's opinion

Table 8: Four of fourteen factors classification

With these data correlation and regression Multivariable were done, and it was found a strong relationship with precision of 0.914, as shown in Table 9.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.805 <sup>a</sup>	0.648	0.509	0.914

Table 9: Multivariable correlation and regression

The most important factors were obtained, and they are shown in Table 10.

To have an affinity for logic
Job opportunities
Social abilities
High school professor's opinion
To be interested in videogames
Collaborative work ability
To be interested in current trends and mode of technology
Leadership abilities
Math ability
To have an affinity for management

Table 10: The most important factors ordered by importance

In addition, different analysis was applied about ANOVA of one factor and ANOVA of several factors [13]. It was used each one the last six questions of the survey that contain statistically information of people who answered the questions. The main factors, with the biggest importance and they are shown in Table 11.

Programming ability
To have an affinity for logic
To be interested in videogames
Ability in interpersonal relationships and communication
Friend's opinion
Job opportunities
The reputation of the university

Table 11: The most important factors from ANOVA analysis

It is important to note that several factors that were gotten in this part of the analysis are the same which were found in the multivariable correlation and regression; so it means that the study was consistent.

## 6. CONCLUSIONS AND FUTURE WORK

IT bachelor has had great success among students because they feel that it is complete and the field work can be wide. Information Technology is not the exception and a few years now emerged with careers that combine graphic design. Some courses offered by universities are: Digital Animation and Design by Computer. These ideas have been very valuable and have generated interest to students, but the authors think that several of these decisions have been studied widely according to relevance and how many of these bachelors will have a workplace for graduates. Moreover and the most important: what other areas or disciplines can be combined successfully with Information Technology to create interesting market niches

that allow future professionals in the workplace inserted successfully, satisfying specific needs and solving problems that impact in the society.

According the results of the study, some actions to take are: 1) To encourage an interest in logic to students since they are studying high school through games, lectures and applying it in real cases, 2) To promote the IT majors in high school and putting special emphasis on job opportunities and different areas of professional development, 3) To encourage social abilities in students because in that way they can work in collaborative and interdisciplinary situations, 4) To talk with high school professors showing the importance of IT career, 5) To show to students the difference between playing videogames and programming them, 6) To design more collaborative activities for students because in that way they can achieve significant learning, 7) To work more with students in lectures and research about trends and mode in Technology Information, 8) To develop leadership in students through activities, competitions and workshops, 9) To take action in activities which improve student's Math abilities, 10) To study about basic management processes which are implied with IT.

It is necessary the participation of more studies in different areas or disciplines to improve this job; thus, it is desirable a depth study of several sectors related, like entrepreneurs, former students that concluded their studies and former students that change their option of bachelor.

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